

Amended" instead of "Presently Amended". Applicant believes that no fees are required with this paper, but should any fees be required for any reason relating to the enclosed materials, the Commissioner is authorized to deduct said fees from Deposit Account No. 01-2508/12740.0225.NPUS01.

Amendments to the claims are reflected in the listing of claims, which begins on page 3 of this paper.

Serial No.: 09/779,872

Page 2 of 9

I. AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings of claims in the application.

Listing of Claims

1. (Currently Amended) An electrochemical fuel cell comprising first and second monolithic electrically conducting flow field-bipolar plate assemblies arranged essentially parallel to each other such that an inside surface of the first flow field-bipolar plate assembly is facing an inside surface of the second flow field-bipolar plate assembly, wherein the flow field-bipolar plate assemblies are electrically and mechanically connected by intervening layers, the intervening layers comprising:

a first electrically conducting intermediate layer bonded directly to the inside surface of the first flow field-bipolar plate assembly,

a second electrically conducting intermediate layer bonded directly to the inside surface of the second flow field-bipolar plate assembly,

a first electrode bonded directly to the inside surface of the first electrically conducting intermediate layer,

a second electrode bonded directly to the inside surface of the second electrically conducting intermediate layer, and

a polymer electrolyte membrane between and bonded directly to both of the electrodes
wherein the monolithic flow field-bipolar plate assemblies comprise a first and second porous metal flow field directly bonded to opposite sides of an electrically conducting gas barrier by continuous metallurgical bonds and wherein the porous metal flow fields are configured to deliver gaseous reactants to the intermediate layers by flowing through the pores of the porous metal flow fields.

Serial No.: 09/779,872

Page 3 of 9

2. (Cancelled)

3. (Currently Amended) The electrochemical fuel cell of claim [[2]] 1, wherein the porous metal flow fields are directly bonded to the electrically conducting gas barrier by electroplating or sintering.

4. (Currently Amended) The electrochemical fuel cell of claim [[2]] 1, wherein the electrically conducting gas barrier comprises a metal foil.

5. (Currently Amended) The electrochemical fuel cell of claim [[2]] 1, wherein at least one porous metal flow field comprises a three-dimensional reticulated metal structure.

6. (Currently Amended) The electrochemical fuel cell of claim [[2]] 1, wherein at least one porous metal flow field further comprises a protecting layer disposed on at least one surface thereof.

7. (Original) The electrochemical fuel cell of claim 6, wherein the protecting layer comprises a metal or a metal oxide.

8. (Original) The electrochemical fuel cell of claim 7, wherein the protecting layer is a continuous layer of tin oxide.

Serial No.: 09/779,872

Page 4 of 9

9. (Original) The electrochemical fuel cell of claim 1, wherein the intermediate layer comprises a polymer and high surface area carbon particles.

10. (Original) The electrochemical fuel cell of claim 9, wherein the polymer comprises polytetrafluoroethylene, perfluoroethylene-perfluoropropylene copolymer, perfluoro-alkoxy, or polyvanilidene fluoride.

11. (Original) The electrochemical fuel cell of claim 1, wherein the electrode comprises a polymer electrolyte and an electrocatalyst.

12. (Original) The electrochemical fuel cell of claim 1, wherein at least one of the flow field-bipolar plate assemblies comprises a first metal flow field directly bonded to the outside surface of an electrically conducting gas impermeable barrier, a second porous metal flow field directly bonded to the outside surface of a second electrically conducting gas impermeable barrier, and a porous metal cooling field disposed between and directly bonded to the inside surfaces of the first and second gas impermeable barriers.

13. (Currently Amended) An electrochemical fuel cell stack comprising two electrically conducting end-plates and a plurality of electrochemical fuel cells disposed between the endplates, wherein the electrochemical fuel cells comprise first and second monolithic electrically conducting flow field-bipolar plate assemblies arranged essentially parallel to each other such that an inside surface of the first flow field-bipolar plate assembly is facing an inside surface of the second flow field-bipolar plate assembly, wherein the flow field-bipolar plate

Serial No.: 09/779,872
Page 5 of 9

assemblies are electrically and mechanically connected by intervening layers, the intervening layers comprising:

a first electrically conducting intermediate layer bonded directly to the inside surface of the first flow field-bipolar plate assembly,

a second electrically conducting intermediate layer bonded directly to the inside surface of the second flow field-bipolar plate assembly,

a first electrode bonded directly to the inside surface of the first electrically conducting intermediate layer,

a second electrode bonded directly to the inside surface of the second electrically conducting intermediate layer, and

a polymer electrolyte membrane between and bonded directly to both of the electrodes
wherein the monolithic flow field-bipolar plate assemblies comprise a first and second porous metal flow field directly bonded to opposite sides of an electrically conducting gas barrier by continuous metallurgical bonds and wherein the porous metal flow fields are configured to deliver gaseous reactants to the intermediate layers by flowing through the pores of the porous metal flow fields.

14. (Currently Amended) A method of making a fuel cell stack comprising disposing between two electrically conducting endplates a plurality of electrochemical fuel cells, wherein the electrochemical fuel cells comprise first and second monolithic electrically conducting flow field-bipolar plate assemblies arranged essentially parallel to each other such that an inside surface of the first flow field-bipolar plate assembly is facing an inside surface of the second

Serial No.: 09/779,872

Page 6 of 9

flow field-bipolar plate assembly, wherein the flow field-bipolar plate assemblies are electrically and mechanically connected by intervening layers, the intervening layers comprising:

a first electrically conducting intermediate layer bonded directly to the inside surface of the first flow field-bipolar plate assembly,

a second electrically conducting intermediate layer bonded directly to the inside surface of the second flow field-bipolar plate assembly,

a first electrode bonded directly to the inside surface of the first electrically conducting intermediate layer,

a second electrode bonded directly to the inside surface of the second electrically conducting intermediate layer, and

a polymer electrolyte membrane disposed between and bonded directly to both of the electrodes

wherein the monolithic flow field-bipolar plate assemblies comprise a first and second porous metal flow field directly bonded to opposite sides of an electrically conducting gas barrier by continuous metallurgical bonds and wherein the porous metal flow fields are configured to deliver gaseous reactants to the intermediate layers by flowing through the pores of the porous metal flow fields.

15. (Currently Amended) A method of generating electrical power comprising supplying hydrogen and oxygen to an electrochemical fuel cell stack,

wherein the electrochemical fuel cell stack comprises two electrically conducting endplates and a plurality of electrochemical fuel cells disposed between the endplates; wherein the electrochemical fuel cells comprise first and second monolithic electrically conducting flow

Serial No.: 09/779,872

Page 7 of 9

field-bipolar plate assemblies arranged essentially parallel to each other such that an inside surface of the first flow field-bipolar plate assembly is facing an inside surface of the second flow field-bipolar plate assembly, wherein the flow field-bipolar plates assemblies are electrically and mechanically connected by intervening layers, the intervening layers comprising:

a first electrically conducting intermediate layer bonded directly to the inside surface of the first flow field-bipolar plate assembly,

a second electrically conducting intermediate layer bonded directly to the inside surface of the second flow field-bipolar plate assembly,

a first electrode bonded directly to the inside surface of the first electrically conducting intermediate layer,

a second electrode bonded directly to the inside surface of the second electrically conducting intermediate layer, and

a polymer electrolyte membrane between and bonded directly to both of the electrodes
wherein the monolithic flow field-bipolar plate assemblies comprise a first and second porous metal flow field directly bonded to opposite sides of an electrically conducting gas barrier by continuous metallurgical bonds and wherein the porous metal flow fields are configured to deliver gaseous reactants to the intermediate layers by flowing through the pores of the porous metal flow fields.

16. - 42. (Cancelled).

Serial No.: 09/779,872

Page 8 of 9

The Examiner is invited to contact the undersigned patent agent at 713-787-1558 with any questions, comments or suggestions relating to the referenced patent application.

Respectfully submitted,



Raymond Reese
Reg. No. 47,891
Patent Agent for Assignee
The Texas A&M University System

HOWREY SIMON ARNOLD & WHITE, LLP
750 Bering Drive
Houston, Texas 77057-2198
(713) 787-1400

Date: March 10, 2004

Serial No.: 09/779,872
Page 9 of 9